

REMARKS

Favorable reconsideration of this application in view of the amendments and remarks to follow is respectfully requested. Since the present Response raises no new issues, and in any event, places the application in better condition for consideration on appeal, entry thereof is respectfully requested under the provisions of 37 C.F.R. §1.116.

Applicants acknowledge, with thanks, the Examiner's indication in the Final Rejection dated May 10, 2004 that Claims 5-15, 24-28, and 30-32 are allowable over the art of record if amended to include all the limitations of the base claim. Although Claims 5-15, 24-28, and 30-32 have been indicated as allowable subject matter over the referenced prior art, applicants, at the present time, would like to obtain a patent including all the claims pending in the present application.

Figures 1-14 stand objected to by the Draftsman under 37 C.F.R. §1.84 or §1.152 for minor informalities, such as copy machine marks, poor line quality and improper reference character format. Applicants concurrently submit formal drawings under separate cover in satisfaction of this requirement. In light of the submitted formal drawings, applicants respectfully request that this objection be removed.

Before addressing the specific grounds of objections and rejections recited in the Final Rejection, applicants have amended Claims 1, 2, 7, 11-14, 22, 23, 27-29, and 32 and have canceled Claims 16-21 and 33. Claims 16-21 and 33 were previously withdrawn as directed to the non-elected claims of the restriction requirement dated August 8, 2003. In response to the Examiner's comments and for the purposes of advancing prosecution applicants' have canceled the non-elected claims.

Claims 1 and 22 have been amended to recite that the edge width measurements correspond to changes in the "profile angle of the photosensitive resist." Claim 29 has been amended to recite that the "three dimensional profile changes correspond to changes in profile angle of the photosensitive resist". Support for the amendments to Claims 1,

22, and 29 can be found on Page 10, paragraph 1, of applicants' disclosure and FIG. 1(c). Referring to Page 10, paragraph 1, applicants' disclose with reference to FIG. 1(c)ii, "that defocus is revealed when by a relatively large edge width 163 vs. the cross sectional line width 164 of the scanned line." Applicants' further disclose, with reference to FIG. 1(c)iii, that an in focus imaged resist hole is shown to have a steep profile going from top to bottom of the hole." Referring now to FIG. 1(c)iv, applicants further disclose that the defocused imaged resist hole has a relatively shallow top to bottom profile grade 166." The terms "steep" and "shallow" profile are a characterization of the profile angle. Therefore, the amendments to Claims 1, 22 and 29 are supported by the applicants' specification.

Further search is not required for consideration of amended Claims 1, 22, and 29 since the limitation added is a component of the "three dimensional feature changes" and therefore previous searches relating to the "three dimensional feature changes" are applicable to amended Claims 1, 22 and 29. Since the above amendments do not introduce any new matter into the application entry thereof is respectfully requested.

Claims 2, 4-15, 23-28 and 32 stand objected to under 3 C.F.R. §1.75(a) for allegedly failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. In response to the Examiner's comments and for the purposes of advancing prosecution, applicants have amended the objected claims in a manner that more clearly and distinctly claims the subject matter of applicants' invention. The specific grounds of objection and the amendments to the objected claims are now discussed in more detail.

Claims 2 and 23 have been objected for reciting the term "said plurality of edge width versus focus data points," which allegedly lacks clear antecedent basis. Applicants have amended Claims 2 and 23 to recite "said plurality of edge width measurements versus focus data points", wherein antecedent basis for these amendments are in amended dependent Claims 1 and 22, respectively. In light of the amendments to Claims 2 and 23, applicants respectfully request that the objections be withdrawn.

Claim 7 has been objected for reciting the term “said feature,” which allegedly lacks clear antecedent basis. Applicants have amended Claim 7 to recite “said measurements of three dimensional feature changes”, wherein antecedent basis for this amendment is in amended dependent Claim 1. In light of the amendment to Claim 7, applicants respectfully request that the objection be withdrawn.

Claim 11 has been objected for reciting the term “said average edge width”, which allegedly lacks clear antecedent basis. Applicants have amended Claim 11 to recite “said average of said edge width”, wherein antecedent basis for this amendment is in dependent Claim 10. In light of the amendment to Claim 11, applicants respectfully request that the objection be withdrawn.

Claims 12, 13, and 27 have been objected for reciting, the term “said tool”, which allegedly lacks clear antecedent basis. Applicants have amended Claims 12, 13, and 27 to recite “said photolithographic exposure tool”, wherein antecedent basis for these amendments are in dependent Claims 10 and 26. In light of the amendments to Claims 12, 13 and 27, applicants respectfully request that the objections be withdrawn.

Claim 14 has been objected for reciting, the term “said equation”, which allegedly lacks clear antecedent basis. Applicants have amended Claim 14 to recite “said equation which characterizes said plurality of edge width vs. focus data point to define said function”, wherein antecedent basis for this amendment is in dependent Claim 6. In light of the amendment to Claim 14, applicants respectfully request that the objections be withdrawn.

Claim 28 has been objected to for recited the term “the wafer”, which allegedly should recite “the production wafer”. In response to Examiner’s comments and for the purposes of advancing prosecution applicants have amended Claim 28 to recite “the production wafer”. Applicants have also amended Claim 28 to change step “e” to step “f”. In light of the amendments to Claim 28, applicants respectfully request that the objections to Claim 28 be withdrawn.

Claim 32 has been objected to for being dependent on Claim 30 and reciting the term “seventh computer program readable code”. There is no “sixth computer program readable code” recited in Claim 30. Applicants have changed the dependency of Claim 32 to be dependent on Claim 31, wherein Claim 31 recites “sixth computer program readable code”. In light of the amendment to Claim 30, applicants respectfully request that the objections to Claim 30 be withdrawn.

Claims 1-4, 22, 23 and 29 stand rejected under 35 U.S.C. §102(b), as allegedly anticipated by Ausschnitt, et al. It is axiomatic that anticipation under §102 requires the prior art reference to disclose every element to which it is applied. *In re King*, 801 F.2d 1324, 1326, 231 USPQ 36, 138 (Fed Cir, 1986). Thus, there must be no differences between the subject matter of the claim and the disclosure of the prior art reference. Stated another way, the reference must contain within its four corners adequate direction to practice the invention as claimed. The corollary of the rule is equally applicable: absence from the applied reference of any claimed element negates anticipation. *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 1571, 230 USPQ 81, 84 (Fed. Cir. 1986). Applicants submit that the applied reference, Ausschnitt, et al., fails to anticipate applicants’ invention, since the reference fails to disclose each and every element of the applicants’ claimed method. *See In re King*, 801 F.2d 1324, 1326, 231 USPQ 36, 138 (Fed Cir, 1986).

Applicants disclose a method of controlling the focus errors of a photolithographic exposure tool comprising the steps of making measurements of three dimensional feature changes in a photosensitive resist, wherein the measurements include edge width measurements *and said edge width measurements correspond to changes in profile angle of said photosensitive resist*; generating a function which defines a relationship between the feature measurements and the focus of the photolithographic exposure tool; and computing from the function a best profile focus value wherein the best profile focus value is used for controlling the focus errors of the photolithographic exposure tool. Applicants further disclose that the measurements of three dimensional

feature changes in the photosensitive resist are three dimensional *profile* measurements of the design features. See Page 9, lines 5-10.

The three dimensional profile measurements represent the sidewall angle, also referred to as the profile angle of the photosensitive film. The sidewall angle is determined by measuring *at least the edge line width of design features*. The edge line width is measured by determining the difference between the width of the base of the photoresist structure and the width of the upper surface of the photoresist structure. By determining the difference in the width of the base and the upper surface of the photoresist structure information regarding the angle, or slope, of the photosensitive resist profile is determined.

FIG. 1(C) depicts the relationship between the photosensitive resist profile angle and the measurement of the difference between the width of the base and the width of the upper surface of the photosensitive resist determined by edge width measurements. Comparing edge width measurements of a focused photosensitive resist, as depicted in FIG. 1(C)iii, with edge width measurements of an out of focus photosensitive resist, as depicted in FIG. 1(C)iv, clearly illustrates that the focused photosensitive resist, having a steep profile angle has, a smaller edge width measurement then the unfocused photosensitive resist structure, having a shallow profile angle.

Referring first to the rejections of Claims 1-4, 22 and 23, applicants submit that Ausschnitt, et al. fail to anticipate applicants' claimed method of controlling the focus errors of a photolithographic exposure tool, since Ausschnitt, et al. fail to disclose making measurements of three dimensional feature changes in a photosensitive resist, *wherein the measurements include edge line width measurements and the edge line width measurements correspond to changes in profile angle of said photosensitive resist*. Applicants note that the Examiner has admitted on Page 6 of the Final Rejection that the prior art fails to disclose edge line width data points. Ausschnitt, et al. measure the length and width of photosensitive resist features, where the focus or exposure dose parameters are determined by a mathematical function of the width or length dimensions

of the photosensitive resist features. See Column 4, lines 21-29. The mathematical function disclosed in Ausschnitt, et al. is dependent on photosensitive film measurements in the x-axis and y-axis (length v. width). Ausschnitt, et al. do not make measurements of the feature changes in the z-axis, wherein measurements of feature changes in the z-axis correspond to the photosensitive resist profile angle.

Referring to FIG. 1, representing the planar view (downward view) of a photosensitive resist structure measured using the Ausschnitt, et al. method, Ausschnitt, et al. make measurements of the length L and width W of the upper surface of a photosensitive resist structure without accounting for the dimensions of the base. In contrast to the method disclosed in Ausschnitt, et al., applicants' method measures the photosensitive resist profile angle by measuring the change in dimension between the base and the upper surface of the photosensitive resist, as illustrated by the cross-sections of the photosensitive resist and corresponding edge width measurements depicted in FIG. 1(C). Therefore, since Ausschnitt, et al. do not measure the difference in dimensions between the upper surface and the base of the photosensitive resist structure; Ausschnitt, et al. do not make an edge width measurement which corresponds to the photosensitive resist profile angle.

The Examiner alleges that Column 17, lines 1-8 and 39-43, Column 26, lines 46, 47 and 55-58, Column 26, lines 45-67, and FIGS. 9-16 of Ausschnitt, et al. disclose measurements of three dimensional feature changes including a plurality of edge width measurements that correspond *to changes in profile angle of said photosensitive resist*. Applicants respectfully disagree and submit that the passages of Ausschnitt, et al. cited by the Examiner do not represent edge width measurements that correspond to changes in the profile angle; since Ausschnitt, et al. are measuring the length and width of the upper surface of the photosensitive resist and is not measuring the different in the dimensions between the base and the upper surface of the photosensitive. Therefore, since Ausschnitt, et al. do not measure the difference in dimensions between the upper surface and the base of the photosensitive resist structure; Ausschnitt, et al. do not make an edge width

measurement which corresponds to the photosensitive resist profile angle, as recited in amended Claims 1 and 22.

Ausschnitt, et al. fail to disclose measuring changes in the edge width from the upper surface to the base of the photosensitive resist and therefore fail to provide three dimensional measurements of the photosensitive resist including the photosensitive resist profile angle. Therefore, since Ausschnitt, et al. fail to disclose making measurements of three dimensional feature changes in a photosensitive resist, *wherein the measurements include edge line width measurements correspond to changes in profile angle of said photosensitive resist*; Ausschnitt, et al. fail to disclose every limitation of applicants' claimed method, as recited in amended Claims 1 and 22.

Turning to the rejection of Claim 29, Ausschnitt, et al. fail to anticipate applicants' claimed method of controlling the focus errors of a photolithographic exposure tool, since Ausschnitt, et al. fail to disclose making *measurements of three dimensional profile changes in a photosensitive resist, wherein said three dimensional profile changes correspond to changes in profile angle of said photosensitive resist*. As discussed above, the method disclosed in Ausschnitt, et al. for determining focus and exposure parameters is dependent on photosensitive resist measurements in the x-axis and y-axis (length v. width) of a photosensitive resist feature and is independent of the profile angle in the z-axis. Applicants' method determines changes in the sidewall angle of the photosensitive resist *profile* in the z-axis through edge width measurements corresponding to the difference in width of the base and the width of the upper surface of the photosensitive resist structure. Therefore, since Ausschnitt, et al. do not make measurements of three dimensional profile changes in the photosensitive resist wherein *the three dimensional profile changes correspond to changes in profile angle of said photosensitive resist*, Ausschnitt, et al. fail to disclose every limitation of the applicants' claimed method, as recited in amended Claim 29.

Applicants note that a single reference was made to Archie, et al. Archie, et al. disclose critical dimension and tool resolution determination using edge width.

Applicants submit that Archie, et al. disclose a measurement method and does not disclose a method including the step of generating a function which defines a relationship between said measurements of three dimensional features changes and focus of said photolithographic exposure tool, as recited in amended Claims 1, 22, and 29. Therefore, Archie, et al. fail to disclose each and every element of applicants' claimed invention.

The forgoing remarks clearly demonstrate that the applied reference does not teach each and every aspect of the claimed invention as required by *King and Kloster Speedsteel; et. al.*, therefore the claims of the present application are not anticipated by the disclosure of Ausschnitt, et al. Applicants respectfully submit that the instant §102 rejections have been obviated and withdrawal thereof is respectfully requested.

Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,



Steven Fischman

Registration No. 34,594

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, New York 11530
(516) 742-4343
HAH/SF:kc/gc